Integrating Metacognitive Regulation into the Online Classroom Using Student-Developed Learning Plans†

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Students and instructors have been faced with unexpected challenges that presented rapidly due to the COVID-19 pandemic. The pandemic forced students into an unfamiliar learning ecosystem to which they had to quickly adapt in order to continue to be successful in their courses. Literature supports the importance of metacognition and self-regulated learning in the success of students in an online environment. More importantly, the concept of metacognitive regulation, which includes monitoring, planning, executing, and adapting learning strategies, is vital to student academic success. These strategies have been shown to close the opportunity gap observed specifically in persons excluded because of their ethnicity or race (PEERs) in STEM. Outlined here is the use of student-developed learning plans as a guided process to enhance students' metacognitive regulation of their learning. These learning plans provide students a template to assist them in time management, practical study skills and planned study sessions, that are designed to increase their self-efficacy, motivation, and performance in online classes. Moreover, the iterative nature of the learning plan encourages students to continue to use and expand this plan in other academic courses.

INTRODUCTION

Although the use of online learning in higher education has become more common over the last decade, the onset of the COVID-19 pandemic provided little time for instructors and students alike to prepare for the abrupt shift to online education platforms (1). Educators were faced with numerous challenges including converting curricula and laboratories to online versions while ensuring equitable access and engaging students in inclusive, motivating learning environments. Similarly, students found themselves in an unfamiliar learning ecosystem in which they had limited physical interaction. Some students no longer had quiet study places, some shared family computers on unstable internet, and others had difficulties navigating digital technology. In addition to the challenges in providing and receiving education, individuals also encountered heightened personal challenges due to isolation and job loss. In contrast, some students and instructors had a fairly seamless transition to online learning due to access, resources, and previous exposure to online

learning. Nevertheless, as higher education settles into the normalcy of synchronous and asynchronous online learning, the question still remains: how do educators create an environment and provide resources that equip and enable all students to achieve academic success online?

SELF-REGULATED LEARNING

A vital component to student success in an online learning environment is self-regulated learning (SRL), the ability to plan, monitor, and modify one's learning (2). Self-regulated learning is beneficial to student success in that students are better able to understand and plan to complete a task, monitor how well their approach is working, and evaluate and adjust this plan as needed (3, 4). Moreover, SRL includes metacognitive elements that are important for academic achievement (2) and it has been demonstrated that interventions of this kind are particularly beneficial in shrinking the opportunity gaps for persons excluded because of their ethnicity or race (PEERs) (5, 6). However, many students find SRL difficult and may drop-out of a course due to lack of achievement, social isolation, and/or lack of support (7–9).

METACOGNITIVE REGULATION

Metacognition is comprised of two key elements. First is the awareness of our thinking processes and what we

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know. This is termed metacognitive knowledge. Second is the activities we engage in to facilitate our learning, termed metacognitive regulation (10–12). Generally, students enter a classroom plagued with seemingly unanswered questions like "what to study" and "what are the best study strategies for this class" (including timing and method). Although students may desire to improve their study habits, the majority are unable to practically make changes in their learning strategies (4, 5). A better understanding of metacognitive regulation benefits students by increasing self-efficacy, academic achievement, and promoting positive attitude and student motivation (13–16). Overall, improved metacognitive regulation, SRL, and study skills will generate a positive feedback loop that results in academic success (Fig. 1).
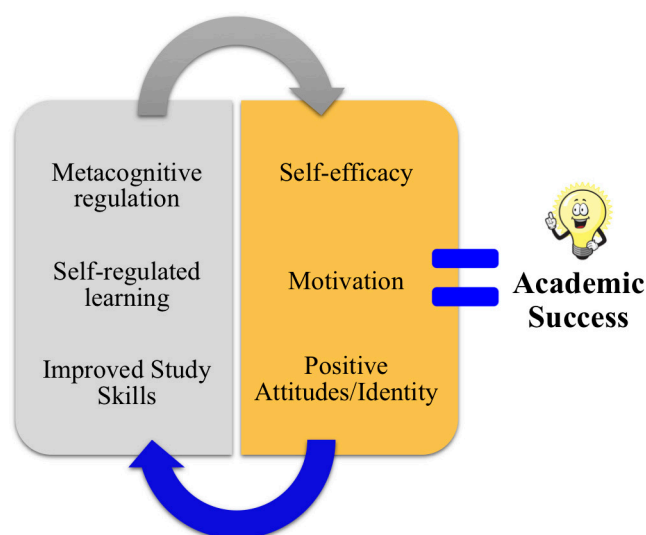

FIGURE 1. Positive feedback loop for student success in online learning.

INTEGRATING A LEARNING PLAN INTO THE CLASSROOM

The learning plan described here consists of two parts: a timesheet and planned study sessions (Appendix 1). Students will construct the time sheet in either a weekly or daily format, depending on which better fits their needs. This starts the students on a reflective journey to assess and prioritize their academic, social, and professional lives. While creating the timesheet, students also consider the learning barriers they may encounter. These barriers can include their work hours, family schedule, or elements such as study space or access. Following identification of these barriers, the students then brainstorm potential solutions or adjustments they can make to overcome these barriers and enhance their learning. This is initially done on their own, but instructors can give feedback during and/or after the students answer the questions. The second part of the learning plan is the planned study sessions. McGuire and McGuire 2018 (17) describes and references how students

can capitalize on both in-class and out-of-class learning using the study cycle, a method given to students at Louisiana State University. When constructing their learning plan, students use only the "intense study sessions" guide (17) to plan study sessions for the scheduled times they indicate on the time sheet. These study sessions are outlined using the topic/chapters from the syllabus leading up to the next exam. Students first establish a study focus, then choose a study strategy/skill, and finally select a reward for after the study session.

Using the learning plan as a class assignment

Prior to the first exam, students are asked to set a personal goal for the grade they wish to earn. Immediately following the first exam, the students engage in an instructor-led personal reflection activity with the following prompts:

1) Did you meet your expected goal for this exam?
2) What study methods did you use for this exam?
3) How long did you study?
4) What might you do differently for the next exam?
5) What will you continue to do?

After this activity, the instructor reviews the purpose of the learning plan and demonstrates how to create one. Students will also receive a handout (Appendix 1) with instructions of how to develop the learning plan. Included with this handout are study tips and templates for a weekly or daily time sheet (not shown). The learning plan may also include strategies for taking notes and engaging during online lectures and other learning resources to optimize the student's learning experience. This assignment is given after the first exam to provide students with enough time to observe the class and make their first attempt using the study skills they know. This gives them more time to reflect as they consider the learning plan. Additionally, after receiving their first exam grade, students are generally more open to advice and change. The students are given one week (after the first exam) to construct their learning plan as an out-of-class assignment. This activity is incentivized by being graded as part of their overall class grade. Completed learning plans are submitted to the instructor.

Students receive written feedback on their learning plan and have the option to sign up for one-on-one feedback discussion with their instructor. Students may also be encouraged to obtain peer feedback on their learning plan. The learning plan is designed to be an iterative process; therefore, students will use and refine their plan throughout the semester as they continue to monitor their learning and performance outcomes in the class. Appendix 2 includes alternative approaches to integrating this assignment into the class that may better fit the class, instructor, and/or student needs.

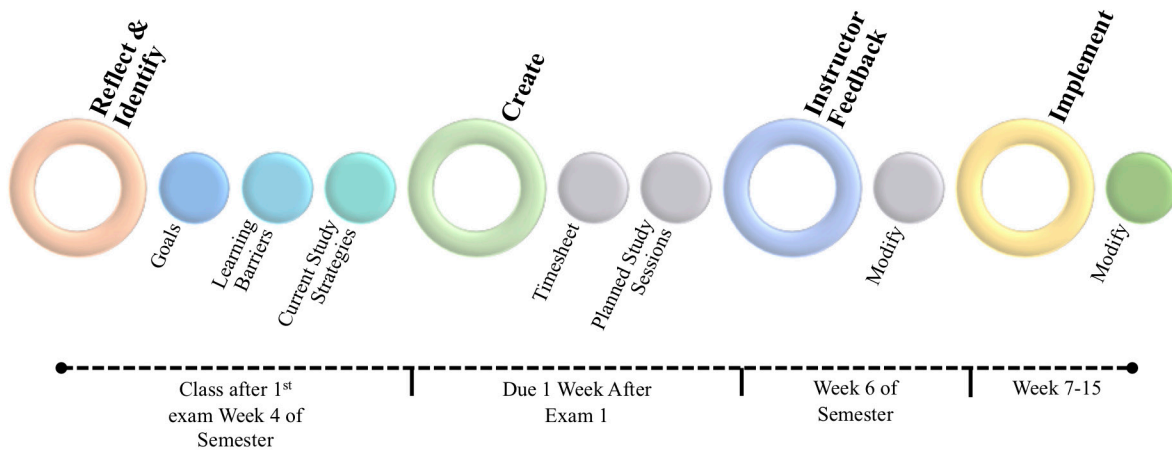In summary, I outline the major steps and flow of this assignment (Fig. 2):

FIGURE 2. Timeline of learning plan assignment in a 15-week semester.

1. Students will reflect on and identify their goals, current learning barriers, and study strategies.
2. Students will develop a learning plan that includes a time sheet and planned study sessions.
3. Students will implement their learning plan and receive instructor feedback.
4. Students will undergo an iterative process of refining their plan.

As an example of the benefits of integrating a student-developed learning plan in the classroom, 14 students in an undergraduate Introduction to Biology classroom were surveyed. The students who participated in the survey self-identified with the following demographics: 21.4% Black or African American, 71.4% Hispanic or Latinx, and 7.2% Asian or Pacific Islander, thus the survey responses are particularly relevant for PEERs; 71.4% of those surveyed are first genera-

TABLE 1.
Open-ended feedback from students using the learning plan.

Prompt	Student Quotes
If you used the timesheet, describe the impact using it had on your study habits, feelings towards online classes, and overall attitude towards your potential success.	1. The time sheet helped me have a consistent schedule and this really helped because with this I was able to get all my assignments done on time. I will continue to use a schedule it helped me stay on task and not get overwhelmed with too many assignments. 2. It would make it easier for me to complete my assignments. 3. I gave myself more time to study.
If you used the study plan, describe the impact using it had on your study habits, feelings towards online classes, and overall attitude towards your potential success.	1. It allowed me to become more organized in terms of studying and submitting work. It made the classes seem easy and clear so my attitude toward my potential success is positive. 2. It motivated me to study harder and not procrastinate. 3. The study plan helped me maintain a good grade in class. However, the class was challenging, but I did succeed.
How have your study habits changed overall since using your learning plan?	1. I'm more consistent and remember I have to go back to my planner and see what I have to get done instead of remembering everything in my head and maybe forgetting to do an assignment. 2. Before, I wouldn't really study but eventually I started to set a time for me to study certain subjects and this helped.
Additional feedback	1. It wasn't easy at first, but with time I got motivated and now I have less stress studying. It actually helped improve my grades in this class and my other classes. 2. Knowing the form of studying I will be doing, it makes me feel a lot more at ease when it is all written down and organized. Writing down a reward was very effective as well. 3. With the learning plan I am able to have enough time for everything instead of feeling overwhelmed.

A   **SCIENCE IDENTITY & BELONGING**
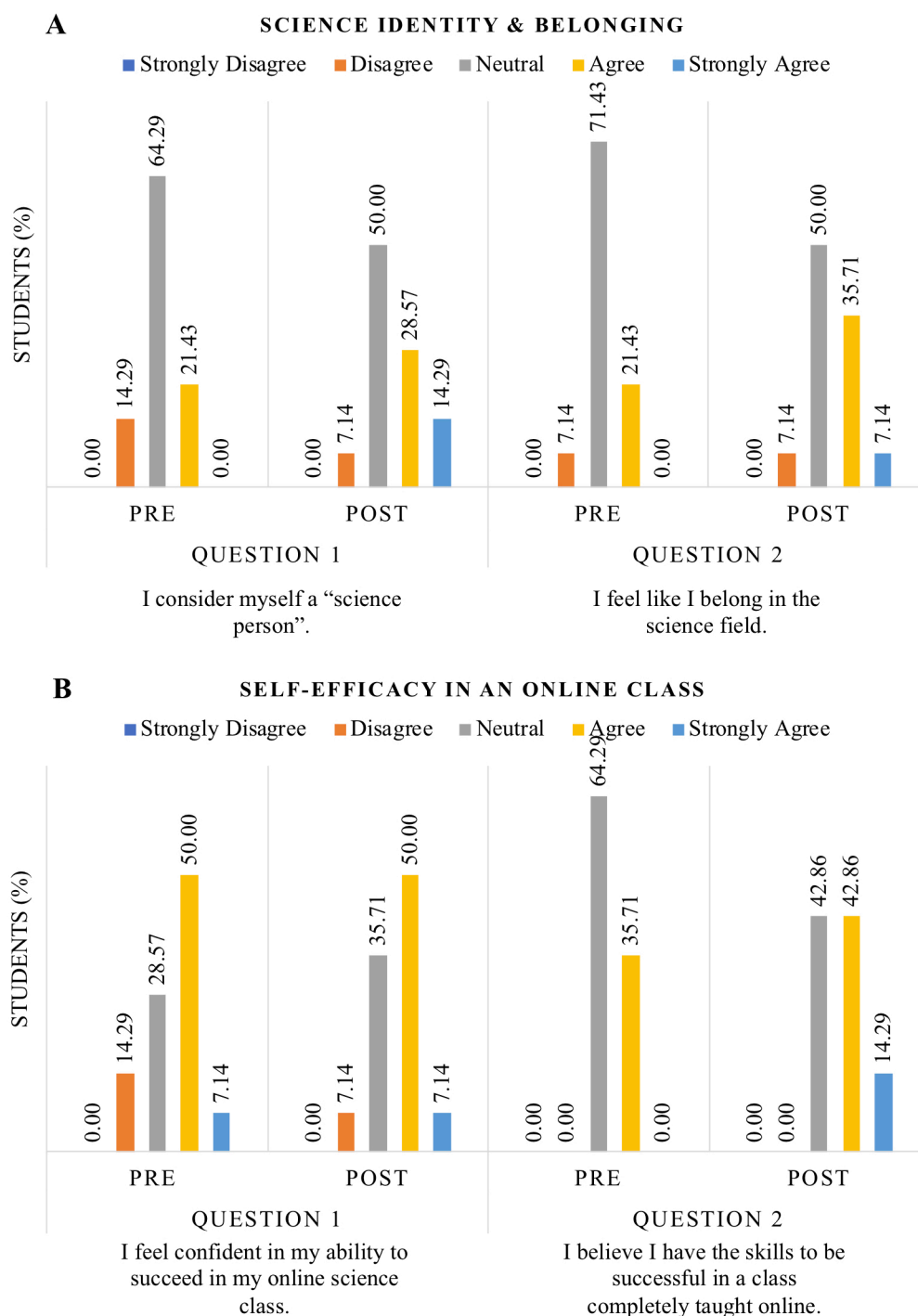

B   **SELF-EFFICACY IN AN ONLINE CLASS**

FIGURE 3. Student attitudinal survey responses. Students were surveyed on a Likert scale from strongly agree to strongly disagree on their science identity (A) and their self-efficacy (B). $N = 14$.

tion college students and almost half work either full- or part-time while in school. More than 50% of the students had never previously constructed a schedule/time sheet, been taught study strategies, or outlined strategies for a class. After the students developed and implemented the learning plan, the data revealed a positive shift in student attitudes towards their science identity and their self-efficacy (confidence in their ability to succeed) in classes taught online (Fig.

3). Most notable is the positive shift observed in students' belief that they have the skills to succeed in an online class. Additionally, student feedback to open-ended questions summarized in Table 1 reveals that students found the learning plans they developed to be helpful in reducing stress, boosting motivation, and improving academic performance. Overall, students found the learning plans to be helpful in their confidence and success in science and online classes.

Finally, students expressed that the assignment indicated that their instructor cared about their academic success by taking the time to provide tools, resources, and assistance.

SUPPLEMENTAL MATERIALS

Appendix 1: Instructions provided to students
Appendix 2: Instructor tips and alternatives

ACKNOWLEDGMENTS

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